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Performance-induced emotions experienced during high-stakes table tennis matches

Carole Sève, Luc Ria, Germain Poizat, Jacques Saury, Marc Durand

Abstract

Objectives: To characterize the contents of emotions experienced by elite table tennis players during high-stakes matches and the situational elements that contribute to these experiences.

Design: A four-case study.

Method: Three top-level table tennis players from the French Men's Table Tennis Team volunteered to participate in the study. Four matches were studied.

Procedures involved: (a) videotaping high-stakes table tennis matches, (b) conducting self-confrontation interviews with players after matches, (c) transcribing the players' actions and self-confrontation data, (d) decomposing their activity into elementary units, and (e) identifying typical contents of emotion and typical emotional situations.

Results: The contents of players' emotions varied during matches. The pleasant or unpleasant tone of emotional content was linked to the set result and the interpretations of the unfolding situation. However, other elements of the competitive interaction (score configurations, judgments about the strokes performed) had a strong emotional coloration. Certain similar events (e.g., bad sensations during stroke performance) were frequently coupled with similar emotional content (e.g., displeasure).

Conclusions: Until quite recently, the predominant focus in sport psychology has been on pre-performance emotions, with far less attention paid to the subjective emotional experiences that occur during task execution. This exploratory study provides initial empirical support for the notion of bi-directionality in emotion–performance relationships.

Introduction

Emotions are a fundamental part of performance and the focus of considerable research in sports (Hanin, 2000). In most cases, the study of the relationship between emotion and performance has been oriented toward an analysis of the influence of emotion, particularly precompetition emotion, on performance. To our knowledge, few studies have described the emotions actually experienced during competition and the way they influence athletic activity (e.g., Jones, Mace, & Williams, 2000; Robazza, Bortoli, & Nougier, 2000; Ruiz & Hanin, 2004; Syrjä, Hanin, & Tarvonen, 1995). Several authors (e.g., Cerin, Szabo, Hunt, & William, 2000; D'Urso, Petrosso, & Robazza, 2002; Hanin, 2000) have nevertheless insisted on the need for studies on the emotions actually experienced during competitions since emotions are modified by actions and the events that one encounters while competing. Emotion–performance relationships are dynamic and bi-directional (Hanin, 2000, 2003). In other words, pre-event emotions can affect performance, whereas on-going performance affects the dynamics of mid-event and post-event emotions. D'Urso et al. (2002) suggested that emotions should be studied in relation to other components of performance.

Lazarus (2000) insisted on the need for empirical studies in the field of sports to characterize the situations in which emotions occur. He defined emotion “as an organized psychophysiological reaction to ongoing relationships with the environment, most often, but not always, interpersonal or social” (p. 231) but noted that this definition is incomplete. It does not integrate the processes involved in arousing and sustaining an emotion, and he considered these processes to be part of the emotion. To explain further, without the continuation of causal thoughts about an ongoing relationship with the environment, emotion disappears or changes, and each discrete emotion tells a different story about a person's adaptational struggle (Lazarus, 1991). To understand emotion, it must be studied in its ecological situation and in close relationship with the judgments of the actors involved in the situation.

The methods used in the studies on emotions in sport are one reason why the emphasis has essentially been limited to emotion as a distinct phenomenon; that is, without other components of performance or the characteristics of context being taken into account. In most cases, studies use scales that the

athletes are asked to fill out either before or after the competition (e.g., Positive and Negative Affect Schedule; Watson, Clark, & Tellegen, 1988; Positive Negative Affect list; Hanin & Syrjä, 1995). To our knowledge, few studies have used interviews to describe emotion in sport (e.g., Gould, Eklund, & Jackson, 1992; Hanton & Connaughton, 2002). Hanin (2003), however, identified diverse data collection techniques for gaining insight into the subjective emotional experiences related to athletic performance (interviews, individualized emotion profiling, self-generated metaphors, narratives) and described the advantages and disadvantages of each. In his estimation, narratives and in-depth interviews can be used to describe concrete performance situations and to identify the thoughts and feelings accompanying these situations.

The framework of the course-of-action theory

The framework of the course-of-action theory (Theureau, 1992) includes a methodology that makes use of the interview techniques of stimulated recall. It thus offers a means to gain insight into emotion that is being experienced even during the course of a competitive performance. This framework was developed in ergonomics for the analysis of work and ergonomic conceptions of work situations. It is thus not specific to the analysis of emotion per se but instead provides a method for reconstructing the meaning an actor gives to his/her own activity. Within this framework, actors' activity can thus be studied in real-work situations so that work performance can be better understood and optimized (e.g., Theureau, 1992, 2000; Theureau & Filippi, 2000).

The course-of-action theory has much in common with the situated approach. Like the situated approach, it is organized around one key idea: affective and cognitive processes are inseparable from the situation in which they take place. These processes participate in the structural coupling of the actor with his or her environment (Varela, 1980) and emerge from the effort to adapt to a context whose significant elements function as resources that the actor can use to act (Hutchins, 1995; Lave, 1988; Norman, 1993). This interaction is asymmetric in that the actor interacts only with those elements of the situation that are relevant to his or her point of view. The course-of-action methodology is based on the notion that activity can be grasped and understood with the aid of a specific theoretical object: the course of action. The course of action is

defined as “the activity of a given actor engaged in a given physical and social environment, where the activity is meaningful for that actor; that is, he can show it, tell it and comment upon it to an observer–listener at any instant during its unfolding” (Theureau & Jeffroy, 1994, p.19). To reconstruct an actor’s course of action during a specific activity period, the course-of-action methodology includes videotaped recordings collected in natural situations followed by self-confrontation interviews in which the actor, while viewing the video images, is urged to recall and explain what he or she was personally experiencing during the activity (Theureau, 1992; von Cranach & Harre, 1982). When asked to describe his or her activity, the actor spontaneously breaks down a continuous stream-of-actions into discrete units that have personal meaning. These discrete units are elementary units of meaning (EUM) whose organization of their succession constitutes the course of action. An EUM is a fraction of activity that can be shown, told, and commented on by the actor. These discrete units, or EUMs, may be physical actions, communicative exchanges, interpretations, or emotions (Theureau, 1992). In the framework of course-of-action theory, elementary units of meaning result from relating three components: the object, the representamen, and the interpretant (Theureau, 1992). The object emerges from the actor’s involvement in the situation (e.g., “Score the point”, “Identify effective serves”): it opens up a field of possibilities for the actor. The representamen is the element of the situation the actor is considering. It is a perceptual (e.g., “The ball is coming long”) and/or mnemonic (“Since the beginning of the set, in the same game configuration, I have consistently placed the ball in the middle of the table”) judgment, or the outcome of the actor’s subjective interpretation of an event in connection with his or her involvement in the situation. The interpretant contains the knowledge the actor uses to interpret the current situation and to act in accordance with past experiences (e.g., “My opponent has a good backhand”, “Varying one’s strokes hinders the opponent’s adaptation process”). It is composed of elements of generality derived from past courses of action. The course of action corresponds to the level of activity that is meaningful for the actor. When this level of activity is examined, pertinent descriptions and explanations are quite likely to result. In sports, this opens up a new perspective on performance because the experience of the athlete is taken into account, providing researchers with access to information

in new dimensions: the interpretations, perceptions, and emotions of athletes during performance. Numerous recent empirical studies in the field of expertise in sports have demonstrated the power of the course-of-action theory (d'Arripe-Longueville, Saury, Fournier, & Durand, 2001; Gernigon, d'Arripe-Longueville, Delignie`re, & Ninot, 2004; Hauw & Durand, 2004, 2005). These analyses have explored competitive experiences in situ by reconstructing the dynamics of the activity as experienced by the athletes, and have thereby enriched our understanding of sports expertise. For example, in table tennis, the study of players' courses of action led to the construction of a grounded theory of elite table tennis players' activity during matches (Se`ve, Poizat, Saury, & Durand, 2006). This grounded theory was constructed from the constant interplay between theoretical constructions and questioning and the empirical results, and was based on the data of previous studies (Strauss & Corbin, 1990). From our first analyses, we constituted the "core" of a theory of table tennis players' activity during matches that was then challenged by, revised and completed in the light of other study results. This grounded theory of elite table tennis players' activity during matches incorporates the three modes of players' involvement identified in our earlier studies: exploration, execution and deception (Poizat, Se`ve, & Rossard, in press; Se`ve, Saury, Ria, & Durand, 2003; Se`ve, Saury, Theureau, & Durand, 2002). These modes express the three characteristic preoccupations of table tennis players: interpreting the interplay of one's own strengths and weaknesses with those of the opponent, scoring points, and influencing the opponent's judgments.

Purpose of the study

Emotion in sports has most often been studied in terms of how emotion influences performance, and few works have investigated the factors that influence emotion. Yet emotion in sports and bi-directionality of emotion-performance relationships, cannot be understood without insight into how the various elements of competitive interaction contribute to the experience of emotion. The purpose of this exploratory study was thus to characterize the influence of three elements on the emotions experienced by table tennis players during high-stakes matches: (a) the unfolding performance, (b) cognitions and interpretations, and (c) the characteristics of match situations. To do so, we adopted the framework of the course-of-action (Theureau, 1992)

insofar as it provides a means for describing and finely analyzing a person's activity in accordance with the concrete circumstances and for grasping the meaning each actor gives to his or her own activity. Four matches were analyzed, two of which concerned the same player. After videotaping the players during high-stakes competition, we showed them the tapes and asked them to comment on their activity. We then reconstructed the individual courses of action in order to characterize the content of emotions experienced during the matches in relation to the elements of the situation taken into account by the players, the in situ interpretations, and the match situations in which

emotions were experienced.

Method

Participants

Three top-level table tennis players from the French Men's Table Tennis Team volunteered to participate in the study. At the time, the players were European Team Champions and World Team Vice-Champions, and they had participated in the Olympic Games. They were 25, 29, and 30 years old, respectively. Although the players did not ask to remain anonymous, they were given the following pseudonyms to guarantee some degree of confidentiality: Luc, Jacques, and Marc.

Procedure

The players' activity was studied in four matches: two for Luc (Matches A and B), one for Jacques (Match C), and one for Marc (Match D). These matches were chosen because the competitive stakes were high: they took place during two international qualifiers for the Olympic Games in Sydney. Match A was held in October 1997 during the table tennis World Cup, and Matches B, C, and D were held in January 1999 during the International Table Tennis Federation Pro-Tour finals (Table 1).

Data Collection

Two types of data were gathered: (a) continuous video recordings of the players' actions during the matches and (b) self-confrontation data. The

matches were recorded on an 8-mm videocamera. The camera was positioned above and behind the table and was set for a wide-angle, fixed, overhead view that framed the table and the movement of both players, the scoreboard and the umpire. The self-confrontation data were obtained during self-confrontation interviews. The self-confrontation interview (von Cranach & Harre', 1982; Theureau, 1992) has points in common with the interview technique of stimulated recall, which was developed and tested by Trudel, Haughian and Gilbert (1996).

Table 1
Characteristics of matches

Match	Player's name	Player's world ranking	Opponent's world ranking	Duration of match (in min)	Result	Number of prior encounters between the two players	Number of wins for the participant
A	Luc	14	7	48	Won 3 sets to 2	5	2
B	Luc	17	9	37	Lost 3 sets to 1	0	—
C	Jacques	14	2	35	Lost 3 sets to 1	2	0
D	Marc	16	2	25	Lost 3 sets to 0	3	3

Note: The players' world rankings were the ones held at the time of the competition.

These interview techniques are based on video recordings of coaches during matches; as the coaches then view these videotapes, they are invited to comment. Trudel and his colleagues (1996) noted that viewing a videotape before commenting on one's own activity may influence the contents of verbalizations. They thus proposed to have the coaches' comment on match events before viewing the tape: the researcher stimulates recall with verbal cues about specific events. After the coaches have commented, they then view the tape and complete their descriptions. During the self-confrontation interviews, we proceeded in similar fashion. The player viewed the videotape of the match with one of the present authors: the researcher stopped the tape before a point was made and asked the player to comment on his actions and the events leading up to the point. The player then viewed the point being scored and completed his descriptions. The interviewer's prompts were related to descriptions of the actions, emotions and events as experienced by the player before, during and after the point, and were designed to collect three types of information: (a) object information (O) (e.g., What are you trying to do?), (b) representamen information (R) (e.g.,

What is drawing your attention?), and(c) information from the interpretant (l) (e.g., What made you decide to do that?).

The present interviews (duration, M \pm 130 min; SD \pm 27:47) were conducted as soon as possible after the matches, depending on the players' availability (the time ranged from 24 to 48 h post-match). None of the players participated in another competition during the interval between match and interview. To avoid potential biases, the coach had agreed not to analyze the match with the players until the interviews were over. The interviews were recorded in their entirety using an 8-mm video camera and a tape recorder. All the interviews were conducted by the same researcher, who had been an elite player at the international level in the past. She was employed by the French Table Tennis Federation as a National Coach in charge of the departments of "Coach Training" and "Research". She knew the athletes and had accompanied them to international competitions. She had already conducted self-confrontation interviews of this type during previous studies and was experienced in interviewing techniques. Several factors worked together to ensure that the interviews were conducted in an atmosphere of trust between players and researcher: they shared a common culture; the researcher was not involved in their training nor in their selection for the team; the players, coach and researcher had formally agreed to collaborate for the study; they shared the goal of improving performance in table tennis; and all players had expressed great interest in the study. By prior agreement from coaches and players, each interview concerned only the player whose match was to be viewed and the researcher. At the end of the interview, the player was free to decide whether or not the interview recording could be made available to the coach and whether or not it could be exploited by the researcher. All players gave permission for all recordings to be made available.

Data processing

The videotapes were viewed in order to draw up an inventory of the two opponents' moves. The players' observable behaviours were systematically coded and transcribed into categories related to the technical language of table tennis (e.g., Luc serves short and backspin to Peter's backhand side. Peter attacks forehand and scores the point). The verbal exchanges between player and researcher during the interview were recorded and fully transcribed. The

data were processed in five steps: (a) generate logs of the matches, (b) label the elementary units of meaning and their underlying constituents, (c) analyze the courses of action, (d) identify typical emotional contents, and (e) identify typical emotional situations.

Generating match logs

This step consisted of generating a summary table or log containing the data collected for each match (Table 2). Labelling the elementary units of meaning and their underlying constituents Each match log was broken down into elementary units of meaning (EUMs). EUMs corresponded to game episodes that were based on what was meaningful for the players. For example, an EUM may have corresponded to an interpretation made before or after a point (e.g., “Decides to serve short to the opponent’s forehand”; “Tells himself Peter is very good today in cross-court backhand”), to the execution of a stroke or a series of strokes (e.g., “Serves short to the opponent’s forehand”; “Maintains the play in cross-court backhand”), or to an emotion experienced during or after a point (e.g., “Disappointed to miss a smash”, “Irritated to see the opponent catching up again”).

Table 2
Excerpt from Match A Log, Set 4

Score	Players’ actions	Self-confrontation data
[4th set] Luc	Luc serves long to Peter’s backhand side. Peter attacks to Luc’s backhand side. Luc blocks to Peter’s backhand side and scores the point	So here I’m doing a long serve. He’s attacking but I’m doing a stroke I like: a sideways backhand block on his backhand. I know the ball will come back to my backhand side. It’s a game configuration that I know and like
0–0		Here I’m pleased, I made a beautiful stroke to start the set and I can feel that I’m really connecting with the ball
1–0		
2–0	Luc serves short to Peter’s backhand side. Peter returns a short ball. Luc attacks and scores the point	Here is a stroke I don’t often do: smash when he returns a short ball. Attacking the ball like that gives me confidence. I don’t often pull off strokes like that
3–0	Luc serves long to Peter’s backhand side. Peter attacks to Luc’s backhand side. Luc attacks to Peter’s forehand side and scores the point	Here it’s perfect. I’m serving like I should. He attacks slowly and I can counter-attack on his forehand side without risk. 3–0, and I feel confident. I’m ahead. and I’m telling myself to

The EUMs were labelled by simultaneously analyzing the match log and the videotapes while asking questions about the player’s actions (What is he doing?), his interpretations (What is he thinking?), and his emotions (What is he feeling?) as they appeared in the log. This analysis was carried out step-by-step for each instant in each course of action, and allowed us to reconstruct a chain

of EUMs for each match (Table 3). The name of the EUM was a phrase that specified the player's physical action, interpretation, and/or emotion, and was labelled on the basis of the verbalized content (Tables 2 and 3). A total of 501 EUMs were identified for Match A, 380 for Match B, 356 for Match C, and 254 for Match D. Fifty-two of the EUMs from Match A concerned the experience of an emotion (emotion-EUMs), as well as 32 from Match B, 33 from Match C and 19 from Match D.

The underlying constituents of each unit of meaning were identified in the excerpt for that unit of meaning by mapping and making inferences about it in relation to the corpus as a whole, and by answering a series of more specific questions (Theureau, 1992): What is the player's concern about this situation (what O)? What element of the situation is he considering, recalling, perceiving, or interpreting (what R)? What knowledge is he using (what I)? As an example, during the first point of Set 4 of Match A, Luc was the server. He served long and Peter (Luc's opponent) returned long to Luc's backhand side.

Table 3
Excerpt from the condensed narrative of Match A, Set 4

Score	EUMs and their underlying constituents
0-0	<p>EUM 1. Serves long to Peter's backhand side O: Score the point R: I am the server. It is the first point of Set 4 I: An opponent returns often this serve to my backhand. I like this game configuration. It's important to score the first points of the set</p>
1-0	<p>EUM 2. Blocks sideways to Peter's backhand side O: Score the point R: The ball is coming to my backhand side I: I like this game configuration. It's important to score the first points of the set</p> <p>EUM 3. Pleased O: Assess the effectiveness of the action produced R: I have made a beautiful stroke to start the set, I have good sensations from the ball I: It's important to score the first points of the set</p>
2-0	<p>EUM 4. Serves short to Peter's backhand side and follows with an attack O: Score the point R: The ball is coming short I: It's important to score the first points of the set</p> <p>EUM 6. Confident O: Assess the effectiveness of the action produced R: I have made a difficult stroke I don't often pull off I: Making difficult strokes gives confidence. It's important to score the first points of the set</p>

Note: EUMs 3 et 6 were labelled as emotion-EUMs.

The analysis of the match log excerpt that corresponded to this moment revealed the first elementary unit of meaning (Serves long to Peter's backhand side) and its underlying constituents; that is to say, Luc's concern (Score the point), the significant element in the unfolding situation (I am the server. It is the first point of Set 4) and the knowledge used (An opponent often returns this serve to my backhand side. I like this game configuration. It's important to score the first point of the set) (Tables 2 and 3).

Analyzing the courses of action

This step consisted of a thorough analysis of the four courses of action in order to identify the manner by which emotions contributed to the activity deployed by the players during the matches. For each course of action, we determined the emotion-EUMs and characterized the preoccupations, interpretations and significant elements that accompanied each of them. For example, the analysis of emotion-EUM 3 presented in Table 3 revealed that the experience of this emotion was linked with two principal elements (representations) for Luc: "I have made a beautiful stroke to start the set" and "I have good sensations from the ball". The analysis of all emotion-EUMs combined revealed two essential phenomena that were noted in all matches: (a) the experience of emotion linked with the judgments being made about the unfolding situation, and (b) either the exaggeration or dissimulation of the emotion being experienced.

Identifying typical emotional contents

This step consisted of comparing the emotion-EUMs in order to identify similar emotional contents experienced by the players during their matches. The identification and labelling of the emotional contents were performed on the basis of the verbalized contents of the self-confrontation interviews. For example, EUMs 6 and 9 were both classed as the same emotional content labelled "confidence". This analysis revealed nine typical contents of emotion for the four matches: confidence, satisfaction, pleasure, relief, displeasure, disappointment, worry, irritation and discouragement.

Identifying typical emotional situations

For each emotion-EUM, we used the players' descriptions to identify the elements of the situation they were involved in when they experienced the emotion. On the basis of these elements, we characterized 18 typical situations during which they experienced an emotion in the four matches (e.g., "Players were ahead in the score and maintained their advantage", "Players had been trailing in the score and were unable to catch up", "Players judged that the opponent was making unaccustomed mistakes", "Players estimated that they themselves had made unaccustomed mistakes"). These 18 typical emotional situations were regrouped into six categories based on the type of element characterizing the situations. The categories were labelled to reflect the type of element. For example, the typical emotional situations of "Players were ahead in the score and maintained their advantage" and "Players had been trailing in the score and were unable to catch up" were grouped into the same category labelled "Score configurations". Typical emotional situations such as "Players judged that the opponent was making unaccustomed mistakes" and "Players estimated that they themselves had made unaccustomed mistakes" were regrouped into a category labelled "Judgments about the strokes".

Assuring credibility

Several measures were taken to enhance the credibility of the data (Lincoln & Guba, 1985).

First, the interviews were conducted in an atmosphere of trust between players and researcher. Second, the transcripts were given back to the participants so that they could ensure the authenticity of their commentary and make any necessary changes to the text. Minor editorial comments were made regarding confrontational responses. Third, the data were coded independently by two trained investigators who reached a consensus on the number and labels of the EUMs. These two researchers had already coded protocols of this type in earlier studies, had previous experience in table tennis, and were familiar with course-of-action theory. The reliability of the coding procedure was assessed using Bellack's agreement rate (Turcotte, 1973). The initial agreement rate was 85% for the EUMs and 80% for their underlying constituents. Any initial disagreements about EUMs or underlying constituents were resolved by discussion between the researchers until a consensus was reached. The typical emotional situations were then identified by these two

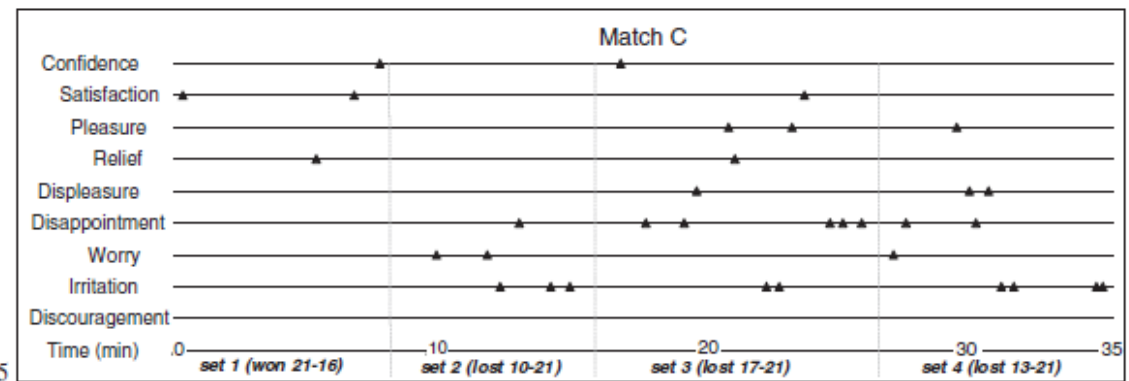
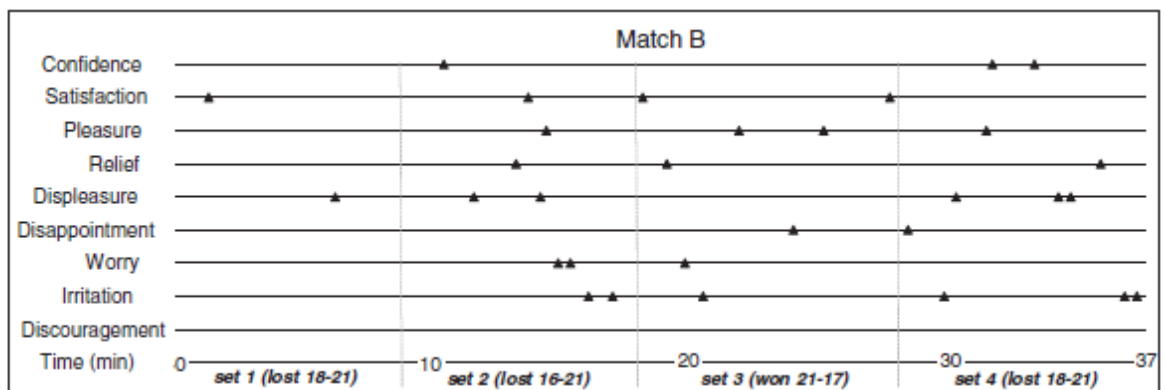
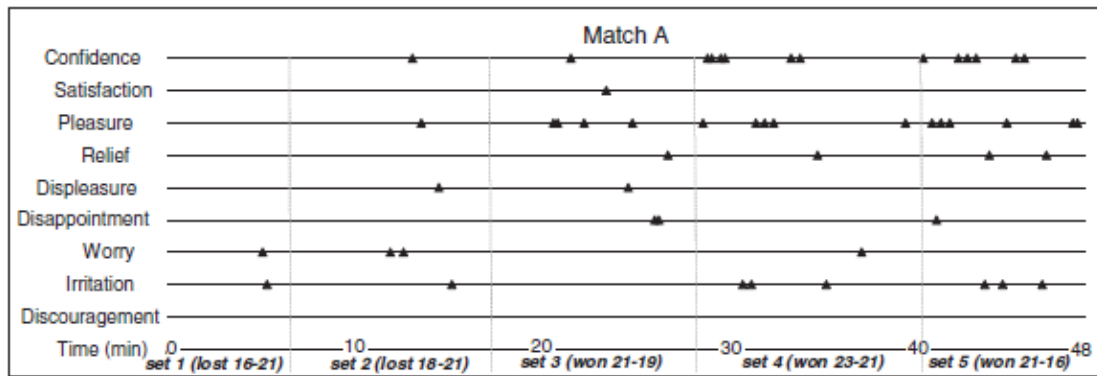
researchers. The initial agreement rate was 90% for category coding. The researchers discussed any disagreements until a consensus was reached. This method is justified by the thoroughness of our mode of data analysis. Reconstructing a course of action is more than simply coding data. It requires a plausible interpretation of a dynamic construction of activity. Plausibility was ensured by the simultaneous and parallel reconstructions of the two researchers, who were willing to discuss and debate their interpretations until a consensus was reached.

Results

The results are presented in three stages (a) the contents of emotion and the temporal arrangement of emotion-EUMs in the matches, (b) the experience and the expression of emotions in relation with judgments about the unfolding situation, and (c) the typical emotional situations. Contents of emotion and temporal arrangement of emotion-EUMs in the matches

The players experienced different emotional contents during matches (Fig. 1 and Table 4).

Some were “pleasant” (confidence, satisfaction, pleasure, relief) and others “unpleasant” (displeasure, disappointment, worry, irritation, discouragement). The contents of emotions differed depending on the matches. During Matches A, B and C, the players expressed eight contents (confidence, satisfaction, pleasure, relief, displeasure, disappointment, worry, and irritation). As an illustration, during Set 5 of Match A, Luc experienced confidence, pleasure, relief, disappointment and irritation. During Match D, Marc expressed only unpleasant contents (displeasure, disappointment, worry, irritation, discouragement). He essentially experienced worry and displeasure during Set 1, irritation during Set 2, and then discouragement during Set 3. The players experienced alternating pleasant and unpleasant emotions during certain sets, and analysis suggested that the pleasant or unpleasant tone of the emotional content was closely linked to the set result (Table 5). During these four matches, 16 sets were played: five sets were won (3 for Match A; 1 for Matches B and C) and 11 were lost (2 for Match A; 3 for Matches B, C and D). For the won sets, the players experienced a greater number of pleasant emotions than unpleasant emotions.



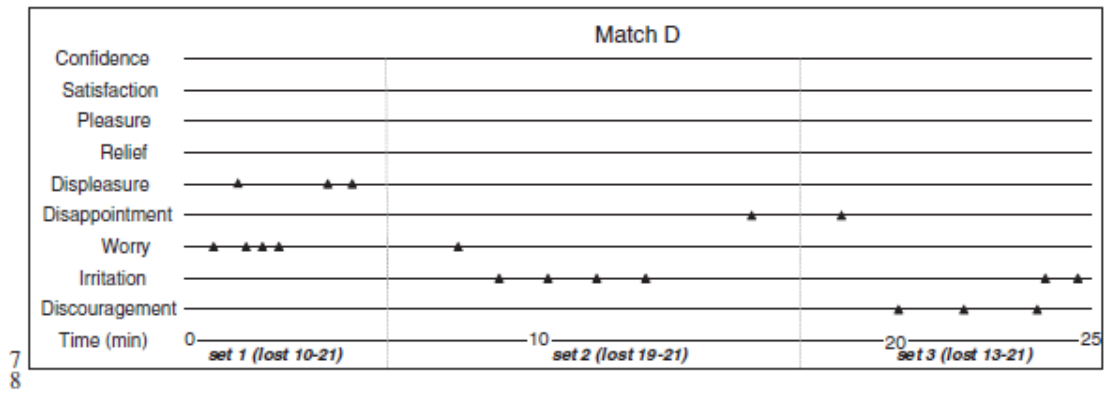


Fig. 1. Temporal arrangement of emotion-EUMs in matches.

Table 4
Number of emotion-EUMs with a pleasant tone and with an unpleasant tone during won and lost sets

	Number of pleasant emotions	Number of unpleasant em
<i>Won sets</i>		
Set 3 (Match A)	7	3
Set 4 (Match A)	12	4
Set 5 (Match A)	14	4
Set 3 (Match B)	5	3
Set 1 (Match C)	4	0
<i>Lost sets</i>		
Set 1 (Match A)	0	2
Set 2 (Match A)	2	4
Set 1 (Match B)	1	1
Set 2 (Match B)	4	6
Set 4 (Match B)	4	7
Set 2 (Match C)	0	6
Set 3 (Match C)	5	8
Set 4 (Match C)	1	9
Set 1 (Match D)	0	7
Set 2 (Match D)	0	6
Set 3 (Match D)	0	6

unpleasant emotions. For 10 of the 11 lost sets, the players experienced a greater number of unpleasant emotions than pleasant emotions. For Set 1 (lost) of Match B, the player experienced only one pleasant and one unpleasant emotion. Although the small number of sets studied did not permit statistical analysis, it appeared that the final score of the set had an impact on the proportion of pleasant and unpleasant emotions experienced by the players. For example, four of the 11 lost sets were lost with a wide gap in the scores: the players in these sets reached a maximal score of 13 points (Match C, Sets 2 and 4; Match D, Sets 1 and 3). These sets figure among those for which

the number of emotion-EUMs with a pleasant tone was the lowest (0 for Set 2 of Match C; 0 for Sets 1 and 3 of Match D; 1 for Set 4 of Match D).

The characteristics of earlier matches against the same opponent influenced the players' emotions during an unfolding match. For example, Marc was playing his opponent for the fourth time and had won the three earlier matches. At the beginning of Set 1, he immediately sought to gain the advantage by reproducing a serve that had perturbed his opponent during their last match: "It's the first serve of the match. I'm serving short topspin to mid-table. In fact, I reproduce the serve that bothered him in Italy so that he doesn't become confident immediately and I can gain a psychological advantage over him". He reproduced this serve four times consecutively and each time his opponent easily returned the ball: "Here I'm already worried. He's not making any mistakes when he returns the serve. He's returning the ball really nicely even though he had been upset by these serves in Italy". The characteristics of earlier matches against other opponents in the current competition or in past competitions also had an influence on emotion. During Match A, Luc lost two sets to zero

TABLE 2
Number of occurrences of emotional contents during matches

Emotional contents	Match A	Match B	Match C	Match D	Total	Examples of self-confrontation data
Confidence	14	3	2	0	19	I'm in good shape. I'm confident (Match A, Set 5, 9–6) It gives me confidence (Match C, Set 3, 3–1)
Satisfaction	1	4	3	0	8	I'm satisfied (Match B, Set 1, 2–1) It's a satisfaction to do a stroke like that (Match C, Set 1, 19–15)
Pleasure	16	4	3	0	23	Here I'm pleased, I made a beautiful stroke (Match A, Set 5, 1–1) I've so good sensations. It's a pleasure (Match C, Set 3, 9–11)
Relief	4	3	2	0	9	I'm relieved that the ball was good (Match B, Set 3, 9–10) I'm relieved being ahead in score (Match C, Set 1, 18–15)
Displeasure	2	6	3	3	14	I don't feel the ball. It's really displeased (Match D, Set 1, 9–18) I feel displeasure. I cannot afford to miss shots like that (Match B, Set 2, 12–13)
Disappointment	3	2	8	2	15	Here I'm really disappointed (Match C, Set 3, 14–17) I'm disappointed to lose this rally (Match B, Set 3, 13–12)
Worry	4	3	3	5	15	Here I'm really worried (Match D, Set 1, 1–3) This worries me a little (Match C, Set 2, 2–5)
Irritation	8	6	9	6	29	I'm irritated here but I'm not showing it (Match B, Set 2, 14–18) I'm beginning to get a little irritated (Match D, Set 2, 7–13)
Discouragement	0	0	0	3	3	I'm a little discouraged here (Match D, Set 3, 5–10) I'm really discouraged (Match D, Set 3, 12–17)

and then two sets to one. He scored the first points in Set 4 and experienced a feeling of confidence. This feeling of confidence was heightened because of the characteristics of the last matches he had played. Here I feel confident. I feel I'm about to pull ahead in the game. And that makes three or four matches where I lose two sets to zero and yet I win. So I'm telling myself that there's no reason why this won't work out.

Experience and expression of emotions in relation with judgments about the unfolding situation
Emotions were experienced and expressed in relation to the meaningful elements in the unfolding situation and to the judgments being made by the table tennis players in situ. Depending on the moment in the match, the players took into account different elements of the interaction. As an illustration, during Set 2 of Match B, with the score 12–11, Luc made a long fast serve to the opponent's backhand side. The opponent returned the serve and got the point with a trajectory that caused the ball to hit the net before bouncing on the table (which prevented Luc from returning it). During this situation, the meaningful element for Luc was the performance of his own serve and not his opponent's return. He was pleased to have made a successful serve and, even though he thought his opponent had been lucky, this judgment was not coupled with an emotion. Here I'm trying a new serve, a long fast serve to his backhand side. He is a little lucky and he "stole" the ball. It's really too bad because that's how he caught up to me in the score—but, that's part of the game. I would have preferred winning the point but I'm pleased to have tried the serve. Sometimes I have to serve long so that he doesn't get too used to returning my short serves. [Match B, Set 2, 12–12] During Set 4, with the score 18–18, the opponent won the point by producing another trajectory that caused the ball to hit the net before bouncing on the table. This event was coupled

with irritation. Here I was attacking really well and then the worst thing happens: he "steals" the ball. He takes the lead in the score by pure luck. Right there I have the impression that the match is starting to turn because I was leading 16–9, I'm now playing with my second racket, and he suddenly steals the ball to take the lead. That is too much, and I get really irritated. [Match B, Set 4, 18–19] These extracts show that emotions were experienced in relation with the interpretation of the unfolding events. This interpretation

itself depended on the player's mode of involvement with the situation, the knowledge being mobilized, and the interpretations that had already been constructed. During Set 2, Luc had identified the serves (short serves with varying direction) that bothered his opponent. Although he used these serves at the start of the set, Luc knew that he was reproducing them too often and that his opponent was going to find a counter-attack. With the score 12–11, he at last decided to perturb his opponent's game by making a serve he had not yet made. The opponent won the point with a trajectory that Luc described as lucky. However, Luc was not affected by this event and he was pleased to have tried a long serve. He felt that this move was going to help preserve the effectiveness of his short serves. When the score was 18–18 in Set 4, Luc tried exclusively to score points. His opponent was winning, two sets to one, and would win the match if he won Set 4. When Luc had been leading 16–9 in Set 4, he thought he had a good chance to win the set. Over the next few points, he varied his strokes and his opponent began to catch up. When the score was 18–16, Luc broke his racket and had to use his spare. At 18–18, his opponent pulled ahead with a shot that Luc again described as lucky. But this event in combination with others (the perception of having lost points foolishly, his opponent catching up in the score, the broken racket) modified his affective state and he now felt irritated.

Moreover, emotions were expressed in relation to the player's in situ interpretation of the situation. The display of emotions did not always correspond to their actual experience (i.e., what was in fact felt by the players). Whether an emotion was displayed depended on its content, as well as its moment of occurrence in the match. The players often masked unpleasant emotions. They judged that showing these emotions would increase their opponent's confidence level. At a score of 7–13, during Set 2 of Match D, Marc felt irritated. He had lost several consecutive points and saw that his opponent was successfully making some extremely difficult shots. He thus did not show his irritation.

Here I'm beginning to get a little irritated. I really feel like I can't counter his game. This is really getting to me but I don't show it. If I do, he'll get even more confident and, for him, the more confident he gets, the easier it is to make really hard shots. [Match D, Set 2, 7–13]

During Set 3 of the same match, at a score of 12–18 (Marc was losing two sets to zero), Marc

attacked. The opponent counter-attacked and scored the point. Marc was irritated and made an ill-tempered gesture. He did not hide his irritation because he judged that he had no more chance of winning the match.

There, I am irritated. I was feeling really great about the point and then he made another incredible shot.

Question: And so there you show that you are irritated?

Yes, at any rate, with two sets to zero and the score at 12–18, there's no point dreaming. I have no chance of winning the match. [Match D, Set 3, 12–18]

Sometimes the players publicly displayed an emotion of satisfaction or confidence to influence the opponent and reduce his feeling of confidence. During Match B, Luc was bothered by the backspin balls that his opponent was returning to his backhand side. He could not manage to attack them effectively. During Set 3, Luc was losing 3–7. He managed to catch up to his opponent with a score of 10–10. The opponent hit another backspin ball to his backhand side. Luc attacked against this backspin ball and scored the point. Throwing his arms in the air, he gave a cry of encouragement. Here I finally make a good shot. This is the first time in the match where I'm able to attack like that. I'm pleased; it's the first time I'm ahead in this set and so I'm showing my satisfaction—to put pressure on him, to show him that I'm still here and I haven't yet lost. [Match B, Set 3, 11–10] Typical emotional situations Eighteen typical emotional situations were identified in conjunction with meaningful elements for the players. All the emotions expressed by the players were experienced in one of these 18 situations. These were regrouped into six categories.

Score configurations

Analysis showed four typical situations pertaining to score configurations (38 occurrences). The players (a) were ahead in the score and maintained their advantage (8 occurrences: 3 in Match A, 1 in Match B, 4 in Match C), (b) had been trailing in the score and were catching up (8 occurrences: 4 in Matches A and B), (c) had been trailing in the score and were unable to catch up (11 occurrences: 3 in Match A, 1 in Match B, 7 in Match D), or (d) had been ahead

but the opponent had caught up to them (11 occurrences: 4 in Matches A and B, 3 in Match C). Confidence, relief or satisfaction was experienced during couplings between the players and one of the first two situations; worry, irritation or even discouragement—when they judged that the score was such that they would not be able to win the set or the match—was experienced during couplings with either of the last two situations. As an illustration, during Match D Marc lost two sets to zero, and during Set 3, when the score was 5–10, Marc judged that he would not be able to win the match and felt discouraged: “Overcoming two sets of 0 and 5–10—I didn’t think I could win. I’m a little discouraged here”.

The win or loss of a point based on numerous rallies

Analysis distinguished two typical situations (17 occurrences). The players (a) won the point after a high number of rallies (at least 4) (10 occurrences: 5 in Match A, 2 in Match B, 3 in Match C) or (b) lost the point after a high number of rallies (7 occurrences: 2 in Matches B and C, 3 in Match D). Pleasure, satisfaction, or confidence was experienced during couplings between players and the first situation, and disappointment or irritation was experienced during couplings with the second. As an illustration, during Set 3 of Match C, with the score 14–17, Jacques lost a point after a long rally and felt disappointed: “Here I’m really disappointed. I had worked hard for the point, I was ready to counter-attack and I missed the defence. It’s never easy to lose points after a long rally—it always brings you down”.

Judgments about the adversarial relationship

Analysis distinguished two typical situations (16 occurrences). The players judged that (a) they had the initiative in the game (they had identified the most effective strokes in the game or the ones that would limit the opponent’s range of responses) (9 occurrences: 7 in Match A, 2 in Match B) or (b) they did not have the initiative (they could not effectively counter the opponent’s strokes or they perceived that the strokes that earlier had been effective were no longer so) (7 occurrences: 1 in Matches A and B, 5 in Match D). Confidence, relief or satisfaction was experienced during couplings between players and the first situation, and worry or irritation was experienced during couplings with the second. As an illustration, during Set 1 of Match D, Marc noted that

his opponent was serving efficiently and this heightened his feeling of worry: "Here I'm really worried. He has already found a serve that bothers me. I have to quickly find a good way to return this serve or else I've got no chance of winning the match". It should be noted that Jacques did not express emotions in relation to judgments about the adversarial relationship.

Judgments about the opponent's level of self-confidence

Analysis distinguished two typical situations (5 occurrences). The players estimated that either (a) the opponent was agitated, discouraged or irritated (3 occurrences: 2 in Match A, 1 in Match B) or (b) he was feeling quite self-confident (2 occurrences: 2 in Match B). Confidence was experienced during couplings with the first situation, and worry during couplings with the second. The players assumed that the effectiveness of the opponent's actions depended in part on his feeling of confidence: the greater the player's confidence, the more difficult shots he will make, and vice versa. The perceptions of the opponent's level of self-confidence also had an influence on the emotion experienced by the players. As an illustration, at the beginning of Set 5 of Match A, Luc saw that his opponent was agitated and this gave him confidence: "Here I can feel that he's agitated. From the minute I see that, I'm in good shape, I'm confident". It should be noted that only Luc expressed emotions in relation to judgments about the opponent's level of self-confidence.

Judgments about the strokes performed

Analysis distinguished six typical situations (56 occurrences). The players (a) judged that the opponent was making unaccustomed mistakes (2 occurrences: 2 in Match A), (b) judged that they themselves had succeeded at very difficult strokes (12 occurrences: 8 in Match A, 3 in Match B, 1 in Match C), (c) experienced sensations that they qualified as "good" (e.g., they had "felt" the ball, perceived themselves as moving very rapidly) (6 occurrences: 5 in Match A, 1 in Match C), (d) judged that the opponent had made very difficult strokes (7 occurrences: 1 in Matches A and D, 5 in Match C), (e) estimated that they themselves had made unaccustomed mistakes (20 occurrences: 7 in Match A, 5 in Match B, 8 in Match C), or (f) experienced sensations that they qualified as "bad" (e.g., they could not really feel the ball, had the sensation of "heavy

legs'') (9 occurrences: 3 in Matches B, C and D). Pleasure, confidence or satisfaction was experienced during couplings with one of the first three situations, and displeasure, irritation or disappointment during couplings with one of the last three. The beginning of Set 4 of Match A illustrates this. Luc noted that he was having good sensations and felt pleasure: "Here I'm pleased, I made a beautiful stroke to start the set and I can feel that I'm really connecting with the ball".

Perception of luck

Analysis distinguished two typical situations (4 occurrences). The players (a) won a point and judged that they had been lucky (they made a "stolen ball") (3 occurrences: 3 in Match B) or (b) they lost a point and judged that their opponent had been lucky (he made a "stolen ball") (1 occurrence: 1 in Match B). Confidence, satisfaction or relief was experienced during couplings with the first situation and irritation during couplings with the second. As an illustration, during Set 3 of Match B, with the score 9–10, Luc felt he had been lucky in scoring the point and felt relieved: "Here I'm a little lucky and I'm relieved that the ball was good". It should be noted that only Luc expressed emotions in relation to the perception of luck. This perception of luck was linked in all four occurrences to "stolen balls"; that is, to balls that hit the net before bouncing on the table. This changed the ball's trajectory and made it impossible to return the ball.

Discussion

The results are discussed in three stages: (a) the influence of performance on the tone of emotional experience, (b) the importance of match histories in the experience of emotions, and (c) the emotional situations in table tennis. The Influence of performance on the tone of emotional experience Although our results must be generalized cautiously because of the small number of matches studied and the disproportion between the won and lost sets, they do indicate that on-going performance affects the dynamics of mid-event emotions. The predominant focus in sport psychology has until quite recently been on pre-performance emotions, with far less attention paid to subjective emotional experiences related to task execution. This exploratory study provides preliminary empirical support for the notion of bi-directionality in

emotion-performance relationships (Hanin, 2000, 2003). It shows that the emotions experienced during table tennis matches differ according to the set results: during losing sets players experience more unpleasant emotions and fewer pleasant emotions than during winning sets. It also seems that the final score of lost sets—or the number of points made by the players—influences the number of pleasant emotions experienced by the player during the set: during sets in which the players made few points, they did not experience pleasant emotions or experienced very few. During winning sets or during lost sets in which the players had made a high number of points, they alternated between pleasant and unpleasant emotions. The pleasant or unpleasant tone of the emotional content thus seemed linked to the effectiveness of their actions. Although a large body of literature has demonstrated that both pleasant and unpleasant emotions can exert facilitative or debilitating effects on performance (Hanin, 2000), our results suggest that during the on-going performance, effective and ineffective actions do not generate the same tone of emotional experience: effective actions were accompanied by pleasant emotions and ineffective actions were accompanied by unpleasant emotions.

The importance of match histories in the experience of emotions

Our results showed that the players experienced diverse emotional contents during the matches. Some contents recurred in several matches (e.g., worry, irritation), whereas others were only observed in a single match (e.g., discouragement). The emotions were experienced in relation to judgments about the elements of the situation that had meaning for the players. These elements could be specific to a player (e.g., judgments about luck) or common to several players (e.g., score configurations). The finding that the players constructed match histories both by and during their activity explains in part the diversity and evolution of the emotions experienced during a match. Table tennis players make sense of the unfolding events of a match by inserting them into much grander and ongoing histories (Se`ve et al., 2002, 2003). These histories thus depend on the characteristics of the specific match and on the individual characteristics of the player. Match histories are built from the strokes performed, the points won and lost, interpretations, knowledge gained about the opponent, and the evolution of concerns and worries. They delimit the meaningful elements in the unfolding situation and

influence their subjective appropriation. Therefore, although a game episode may seem identical to an outside observer (e.g., a ball that hits the net before bouncing onto the table, a big gap in the scores), the players are not making the same interpretations nor are they experiencing the same emotions. Each match is experienced differently. It has its own history that gives a specific emotional coloration to the various game episodes by inserting them into a network of interpretation. For example, in several game episodes during Matches A and B, Luc noted that he had felt good sensations while making shots, but only some of these episodes in Match A were coupled with pleasure. Similarly, in Match B, he was confronted several times by his opponent's "lucky shots" but only one lucky shot was coupled with irritation. Similar emotional contents can also be coupled with quite different meaningful elements in the competitive interaction. During Match C, Jacques experienced irritation several times. Depending on the moment in the match, this irritation was coupled with his opponent catching up in the score, the perception of bad sensations while making a shot, making unaccustomed mistakes, and the opponent's success at making difficult shots. We were unable to accurately distinguish the respective influence of match characteristics and the players' individual characteristics on the experience of emotions. For example, the fact that Marc did not experience a pleasant emotion during Match D may have resulted from personal characteristics, but it may also have been due to the characteristics of the unfolding match (e.g., Marc was never ahead in the score during this match, he never discovered which shots would perturb his opponent, and he quickly began to feel dominated by his opponent). However, when our results are viewed in light of the results of studies on inter-individual emotional differences (e.g., Hanin & Syrja, 1995; Ruiz & Hanin, 2004), the suspicion that the emotions experienced depend greatly on the player is strengthened: Each player seemed to differ in his emotional sensitivity to certain events of the match. For example, even though the three players estimated that they had made lucky shots during the four matches, only Luc (during Matches A and B) felt an emotion during and after some of these shots. Furthermore, the characteristics of the unfolding match history and the players' individual characteristics both become part of a more global history of other matches against the same opponent or other matches against different opponents in the same competition or in earlier competitions. Match histories

also influence the expression of emotions. Players know that the opponent is assessing and judging their emotion and that these judgments will influence their perception of the adversarial relationship and their own feelings of self-confidence (Se`ve, Saury, Leblanc, & Durand, 2005). They thus will look for opportunities to display or, conversely, mask their emotion, and the expression of an emotion will not always be concordant with its experience. Table tennis players face their opponents not only through action but also through the display of emotion. They try to determine the emotions of their opponent to improve their own control of the competitive situation, while they hide or misrepresent their own emotion to influence the judgments that their opponent will make. They use emotional expression as a tool to influence events so that they conform to expectations. These attempts to influence match events by the expression of emotions are not unique to table tennis. Trudel, Dionne and Bernard (1992) showed that hockey players employ strategies of verbal intimidation (notably during game pauses) to break their opponent's concentration and push him to make illegal moves that will be penalized. It thus may be that the expression of emotions is a component of competitive interaction in sports. The emotional situations in table tennis In addition to the uniqueness of each player and each match, our analysis revealed typical emotional situations that recurred during several matches. These emotional situations were characterized by the status and the change in score, the duration of the rallies, and judgments about the strokes performed. These elements of table tennis competitive interaction have strong emotional coloration, whatever the player or match. For example, long rallies are relatively rare during matches. From the players' point of view, they are important: winning a long rally establishes a psychological advantage over one's opponent. Unaccustomed mistakes and bad sensations during strokes were frequently coupled with displeasure or irritation, whereas success at a difficult stroke and good sensations were coupled with pleasure. Over the course of their experiences, the players seemed to stabilize certain couplings of judgments about the situation and the emotional experience. It is likely that the pleasant or unpleasant character of these emotional experiences was linked to the effectiveness or ineffectiveness of the actions performed during or just following these judgments (e.g., since good sensations were frequently associated with effective shots, the players coupled good sensations with a

pleasurable emotional experience). The players constructed typical expectations and experienced typical emotions in relation with judgments about the situation. Although all emotion is relative to a specific state in a situation that will never be identically reproduced, it is the source for the construction of elements of knowledge for the actor (Ria, Se`ve, Saury, & Durand, 2003).

Conclusion

One of the most important objectives of the research on emotion in sports is to describe, explain and predict the emotional patterns (often pre-competitive) associated with poor and optimal performance (e.g., Hanin, 2000). The present study reveals how the unfolding performance, cognitions and match situations contribute to the experience of diverse emotions during the course of a competitive table tennis interaction. It does not, however, directly contribute to the above-stated line of research in the sense that our results described neither the intensity of experienced emotions nor their impact on performance. Other limitations of this study arise from the small number of matches studied and the data processing: although our study allowed us to characterize the impact of performance on the emotions experienced during an unfolding match, it did not permit us to specify the influence of these emotions on the unfolding performance. Complementary studies are needed to better characterize the bi-directionality of emotion–performance relationships. This would entail assessing the impact of emotions on unfolding performance. Although our study showed evidence that certain elements of competitive table tennis interaction contribute to the experience of typical emotional contents, the impact of these emotional contents on the effectiveness of actions undertaken during matches needs to be investigated. It may be that the experience of a pleasant emotion results in lower effectiveness due to a drop in the player's concentration and, conversely, that the experience of an unpleasant emotion leads to greater effectiveness through heightened concentration (Cornelius, Silva, Conroy, & Petersen, 1997). The results of our study allowed us to identify certain match situations that were typically associated with certain emotional contents. An understanding of the impact of these typical emotional contents on unfolding performance could provide the basis for developing new performance aids. This might entail helping players to

recognize the typical match situations in which detrimental or beneficial emotions are experienced, so that they can anticipate and control those emotions that are detrimental to performance and exploit those that are beneficial.

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